

Circadian Lighting with Control4 (OS v3.3.0 and later)

Converging Systems LED Lighting Controller Systems

Min. Requirements

- e-Node/4000
- ILC-400/450
- Latest C4 driver packet for e-Node (V12 or later)
- Composer OS version 3.3.0 or later

Driver Backgrounder

Converging Systems has developed a suite of Control4 field-tested drivers for its ILC-xx0 family of LED lighting controllers. The firm's IP-based communication device (e-Node) fully supports Converging Systems' own CSDDP (Converging Systems Device Discovery Protocol) for the individual discovery of connected lighting controller. Converging Systems continually updates its lighting controller offerings as well as its Control4 driver suite to enable installers to enjoy these new features. One such feature is **Circadian lighting** (see below).

Note: Converging Systems as a corporate policy makes available all of its device drivers for no charge to Converging Systems' dealers who are integrating the firm's hardware. Please refer to this link for more information https://www.convergingsystems.com/inres_control4.php

Although all Converging Systems drivers will eventually be available seamlessly through Composer as become re-certified, latest drivers can always be downloaded here.

http://www.convergingsystems.com/software/local_profiles_library.php#control4

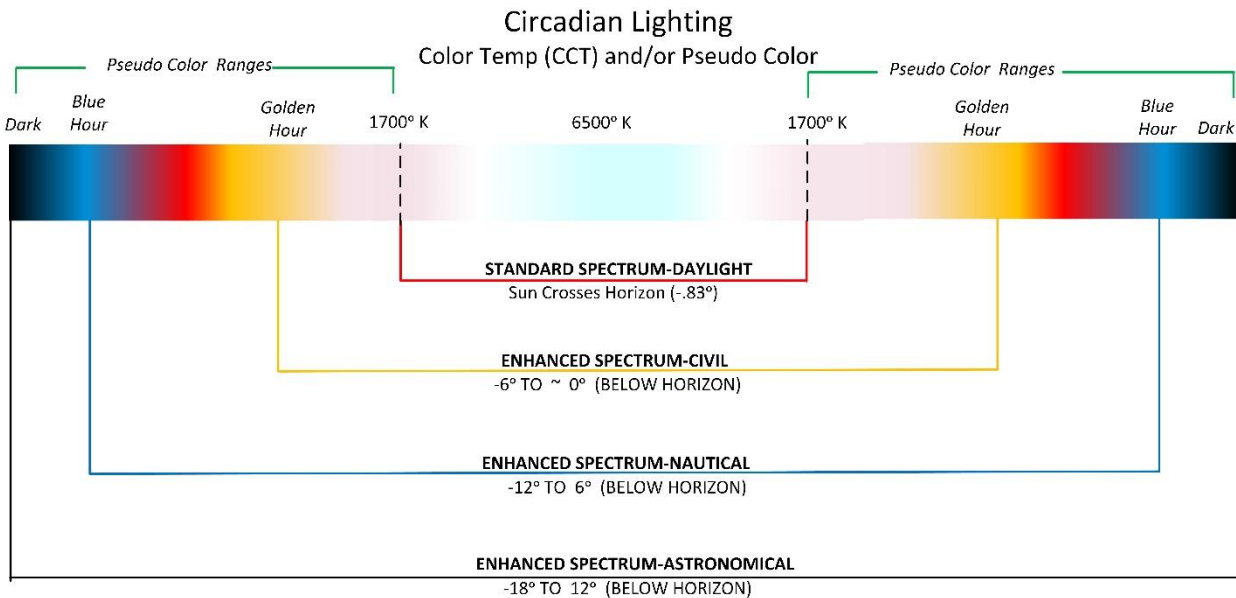
Circadian Lighting

Circadian Lighting is a corollary to human circadian rhythm. Circadian rhythm is a 24-hour clock controlled by the hypothalamus, an area of the brain, that controls each person's circadian rhythm by receiving stimuli from the eyes and signaling when it is daytime and nighttime. Cooler temperatures are used in spaces when it is appropriate to promote alertness and attention. Warmer temperatures (seen when the sun is rising or setting) are used when people are waking up or falling asleep. The concept of using light to influence human circadian rhythm is a relatively new idea in the lighting industry and research continues to provide new findings. Converging Systems has mapped the chromaticity values of the sun on the Big Island of Hawaii (where the atmospheric interference is often less intense and/or impacted by pollution/cloud cover) over a course of a week from total darkness to mid-day sun and then all the way back to darkness over a number of successive days. (This is one of the reasons the Mauna Kea observatory was built at that location). Converging Systems then mapped those values along with proprietary algorithms into a number of our own Circadian-compatible ILC-4xx controllers leveraging off of the e-Node 4000 family's most powerful front-end processor which enables the feature set documented within this Tech Note.

In order to understand the significance of these advancements, the following short section (not mandatory reading) has been created to explain the range of Circadian Lighting output choices available. The built-in intelligence and the user-entered geographical location is all that is required to trigger accurate Circadian lighting capability within this environment. Please note that for simplicity the following description relates to pre-dawn to mid-day sun events (but the concepts are equally applicable-yet reversed for pre-sunset through dusk to total darkness).

Understanding Night to Mid-day Sun Events (or Mid-day Sun to Night Events)

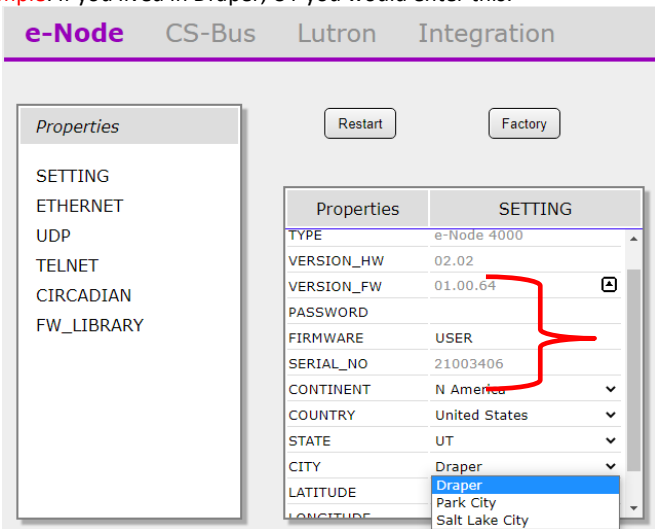
Note there are three major Periods (i.e., Astronomical Twilight (AT), Nautical Twilight (NT) and Civil Twilight (CT)) leading up to traditional DayLight (DL) sun. During each of these periods there are mid-to-wide variations in the chromaticity (Hue and Saturation) as well as Brightness levels perceived by an optical receiver (electronic equipment or the human eye). With proper replication of these variations within each Period, a lighting system can be used to provide a good approximation in many regards (but not all) to the target Sun's output. These periods and their associated light output are quite relevant to replicating Circadian cycles for health, comfort, marketing, or particular product differentiation needs. These Periods are represented by the following figure.

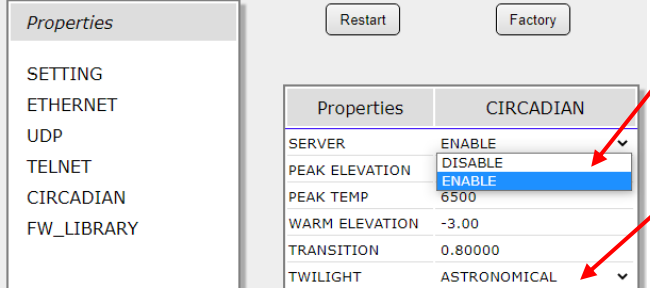
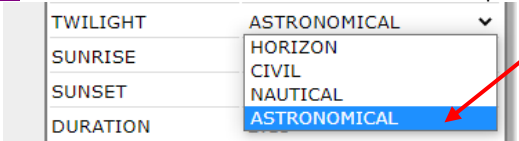
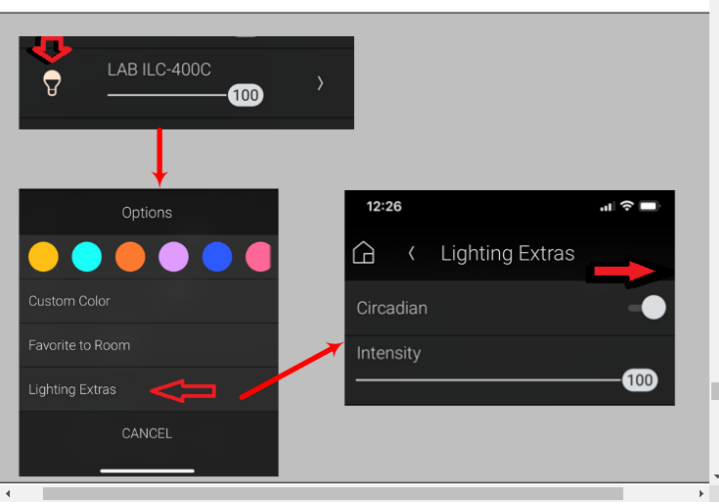


The selection and proper representation of these four types of Circadian cycles is implemented with the e-Node/4000 gateway. For more information, see a separate Tech Note [here](#).

Quick Steps

We have created this Tech Note for installers interested in experimenting and implementing Circadian Lighting from Control4 (v3.3.0 and later) platforms. You are free to modify the assumptions given above for the particulars of your installation.

Step #	Overview	Steps
1	<p>Set-up your location within the e-Node/Settings page.</p> <p>Note: This feature requires that you are initially connected to the internet to access the pre-programmed database of cities and time zones. After the initial setup, it is often not necessary to be internet-connected for proper operation.</p>	<p>Within the e-Node 4000 Settings tab, enter your city or city close to your location or alternatively your Latitude/Longitude (negative sign for West or South entries).</p> <p>Example: If you lived in Draper, UT you would enter this:</p>  <p>Note: Since there is a vast set of cities throughout the world accessible and selectable through the scroll down menu within this setup feature, if your city is not listed, it is generally sufficient only to select the closest city to your location (provided it is within the same time zone as your location).</p>
2	<p>Invoke the Circadian Server's functionality (within the e-Node)</p>	<p>Step 2a. Invoke the Circadian Server.</p> <p>Within the e-Node 4000 Circadian tab, set Server to Enabled (see image 4 below). This sets up the e-Node internally to track all the metrics for the solar cycle for the specific programmed location. However, not until a linkage between a specific Zone/Group/Node (Z.G.N) Device address and the Circadian server (enabled in this Step 2) is set up, will any particular lighting element be considered "Circadian Active." Now proceed to Step 3 to make that linkage.</p> <p>Note: there are additional settings below the Server entry. These are more advanced in concept and can simply be left as is for now.</p>

		 <p>Step 2b. Select the type of Twilight desired. Invoke the Circadian Server. See link here for more information on the various selections possible.</p>  <p>Note: for the most vibrant (and most complete) twilight, select Astronomical.</p>
3	<p>Make any target Zone/Group/Address (address for any ILC-xxx controller) Circadian Active.</p>	<p>Step 1. By using the Mobile App or a C4 Touchscreen, the customer can select any programmed Load device and press and hold the light bulb icon to expose the Options menu.</p> <p>Step 2. On the Options menu, the Lighting Extras entry can be selected. There the customer can activate the Circadian functionality by turning the Circadian switch ON/OFF dot to "ON" and selecting the applicable brightness percentage for the cycle by using the Intensity slider. Once this switch is turned ON, that particular load shall be considered Circadian Active. It will remain Circadian Active until such time that there is an interruption-see Step 4 for more details.</p> 
4	<p>-Retriggering the Circadian Functionality after an "Interruption"</p>	<p>Background on Operation. Once a Z.G.N address (Device) has been made Circadian Active (through initially turning on the Circadian slider in Step 3), the targeted Z.G.N Device will continue to operate outputting a Circadian cycle daily until interrupted. Interrupted means that the Z.G.N Device receives any command (i.e., OFF, ON or any other CCT or Color setting or brightness- SET command). At the point of interruption, the</p>

		<p>Circadian tracking is temporarily suspended until one of the following events occurs:</p> <ul style="list-style-type: none">-The next calendar day occurs when the e-Node Circadian Server will automatically retrigger a Circadian active state as if nothing ever stopped or interrupted it, or-The Circadian On (slider activation in Step 3) is once again triggered.
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